EDITORIAL

The magical land between the kingdoms of Nano and Meta

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EDITORIAL

The magical land between the kingdoms of Nano and Meta

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Guest Editors

This special issue on Nanophotonics and Metamaterials is a follow-up to NANOMETA-2007, a new European Topical Meeting which took place on 8–11 January 2007, Seefeld, Austria (see www.nanometa.org).

The idea of the meeting was to bring together the mature community of microwave electrical engineers and the emerging community of photonics researchers interested in the physics of light coupled to nanostructures. This free-will amalgamation of what for many years were parallel universes of science and technology would not have been imaginable a few years ago. However, recent advances in nanofabrication now allow for the manufacturing of sub-wavelength photonic structures of similar complexity that have been used in the microwave community for many decades. The scale invariance of the Maxwell equations was the underlying driving force that brought these communities together. Optical physicists were asking what could be learnt from the microwave community's experience in structured materials, while microwave scientists who had recently discovered the challenges and fertility of the optical domain were realizing that 'there is plenty of room at the bottom' (R P Feynman): the well understood and harmonized microwave realm becomes thousands of times more complex and polyvalent when the size scale pushes the boundaries of molecular dimensions.

The mutual affinity of the two previously scarcely communicating groups of scientists was catalysed a few years ago by the intriguing opportunity to revolutionize electrodynamics by developing media that displayed negative refraction. From that moment the term 'meta-material' came into widespread use. Today its meaning encompasses materials with all sorts of unusual electromagnetic functionalities that may be achieved by sub-wavelength structuring such as 'invisibility' (as introduced by the novelist HG Wells in *The Invisible Man*); the ability to 'hide' objects in the miraculous manner of Harry Potter's cloak; the intriguing asymmetries of Lewis Carroll's looking glass; Star Wars-like electromagnetic force shields; the quantum levitation of magic carpets; and light harvesting by patterns with the same symmetries as 15th century tile designs (see figure 1).

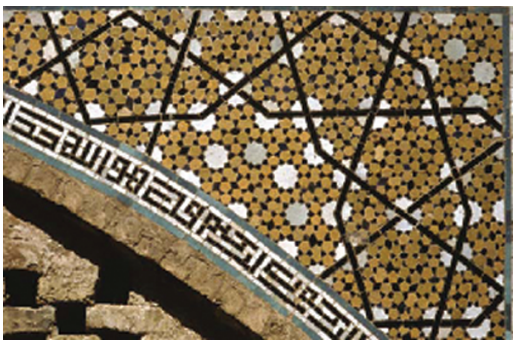

Figure 1. A nanoscale version of this Penrose-like quasi-crystal design found on the Darb-I-Imam shrine, Isfahan, Iran (1453 CE) (reproduced from [1], image courtesy of K Dudley and M Elliff) focuses light on the sub-wavelength scale [2] thus manifesting the optical 'super-oscillation' effects [3].

The promise of the Veselago–Pendry optical negative refraction super-lens capable of resolving features beyond the wavelength limit, possibly even individual molecules, was alone sufficient to mobilize the best minds on both sides of the Atlantic and the Pacific Rim to work at the interface between 'Nano' and 'Meta' [4]. Two plenary talks, opening and concluding the conference, outlined its topical boundaries. They were given by Sir John Pendry (Imperial College London, UK) who spoke on negative index meta-materials and electromagnetic cloaking and Professor Eli Yablonovitch (University of California, Los Angeles, CA, USA) who explored the limits of nano-scale light concentration.

The topical scope of this special issue echoes that of the NANOMETA conference and includes negative index materials, 2D and 3D photonic bandgap structures, light in confined geometries and nano-cavities, surface plasmon–polariton optics, nanostructured metallic and dielectric surfaces, near-field probing and nanoimaging, extraordinary transmission of metallic nanostructures, nanolensing and nanoharvesting of light, nanotransmission lines and nano-antennas, single nanoparticle photonics, quantum effects in nanophotonics, interaction of electron beams with nanophotonic structures.

The Guest Editors of this special issue and co-chairs of NANOMETA-2007, on behalf of the conference organising committee and the European Physical Society would like to thank the PHOREMOST, METAMORPHOSE and Plasmon Nano-Devices EU Networks of Excellence for sponsoring the meeting and the Institute of Physics Publishing for putting together this follow-up special issue.

We would like to take this opportunity to invite members of the nanophotonics and meta-materials communities to take part in the next NANOMETA conference to be held in Seefeld, 5–8 January 2009.

References

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